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COMPLETE SPECIFICATION

Space Heating Device

I, ALLAN WINSTON LUNDSTRUM, a citizen of the United States of America, of 1514 Drover Street, Indianapolis, Indiana, formerly of Heating Research Corporation, 620 West 14th Street, Anderson, Indiana, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :—

This invention relates to space heating devices and relates more particularly to gas or liquid-fired heating devices particularly adapted for domestic use as an auxiliary to or as a substitute for so-called central heating systems in the individual space heating of separate rooms, enclosures, compartments and the like.

Objects and advantages of the invention will be set forth in part hereinafter and in part will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the instrumentalities and combinations pointed out in the appended claims.

The accompanying drawings, referred to herein and constituting a part hereof, illustrate one embodiment of the invention, and together with the description, serve to explain the principles of the invention.

Objects of this invention are to provide a new and improved heating device which is particularly adapted for wall installation and use in existing buildings, vehicles or other structures to be heated, as a main or auxiliary space heating unit ; which is of a configuration and arrangement such that its installation in such structure may be carried out speedily and with only minor alterations of the existing structure ; which combines a high degree of thermal efficiency and heating duty per unit of volume with extreme accessibility for inspection and servicing and with substantial freedom from moving parts ; which is adapted for operation on either gaseous or liquid fuels and is characterized by freedom from hot spots through the provision of a novel and improved internally fired transfer unit offering uniform heat distribution and high heat radiating capacity ; which is characterized further by a novel and improved venting system for so directing and controlling the induction of air to and the eduction of gaseous products of combustion from the combustion chamber of the heat transfer unit that for all practical purposes the combustion chamber is adapted to be vented and may be vented directly to the outside air without the usual lengthy pipes, ducts, chimneys and the like and without danger of blow-out of the flame, under substantially any and all atmospheric conditions to which the induction and eduction ports of the heat transfer unit may be subject in use.

Another object of this invention is to provide a new and improved wall-vented space heating device adapted for operation on either gaseous or liquid fuels which may be installed in new or existing wall structures of greater or lesser relative thickness through the provision of a novel and improved venting system for the combustion chamber adjustable to compensate for the varying wall thicknesses encountered in practice.

Another object of this invention is to provide a new and improved space heating device adapted for burning either gaseous or liquid fuels in a combustion chamber hermetically sealed with respect to the space to be heated and in which device manual adjustment of the fuel-air ratio may be made from the room side easily and at will, without breaking the hermetic seal.

Another object of this invention is to provide a new and improved space heating device for operation on either gaseous or liquid fuels which lends itself readily to fabrication in economic fashion by mass production technique from materials of low cost and in ample supply.

Of the drawings :—

Figure 1 is a view in vertical section of a typical and illustrative embodiment of a space heating device in accordance with this invention, the view showing in side elevation the convector case which encloses the heat transfer unit, showing the device as installed in an outside wall structure of a room and showing also a preferred form of exterior hood-like baffle structure by which the combustion chamber of the heat transfer unit is vented through the wall structure to the outside air;

Figure 2 is a view in vertical section of the embodiment shown in Figure 1, the view being taken along a vertical plane passing through the heat transfer unit and showing the manner in which the burner assembly is disposed at the bottom of the combustion chamber;

Figure 3 is a view in front elevation of the embodiment shown in Figure 1, showing the room cover-panel in full line, and showing, in dotted outline and assembled relationship rearwardly of the room panel, the heat transfer unit with its burner assembly, the convector case surrounding the heat transfer unit, and the box-shaped member for mounting the device in a wall structure;

Figure 4 is a view in elevation of the exterior hood-baffle of the vent system of the device of Figure 1 in installed position on an outside wall structure;

Figure 4a is a view in section of the exterior hood-baffle, taken along the line 4–4 of Figure 4;

Figure 5 is a so-called exploded isometric view of certain of the major elements of the device of Figure 1 wherein the elements, reading from left to right, are: the room panel, the heat transfer unit, the convector case and the box-shaped mounting member, the exterior hood-baffle being omitted in this instance;

Figure 6 is a view in section taken substantially along the line 6–6 of Figure 1 and showing the elements in their assembled relationship to each other and to a wall structure in which the device is installed, the view omitting, however, the exterior hood-baffle of the adjustable venting system, for clarity in showing;

Figure 7 is a view in front elevation of the heat transfer unit of the device of Figure 1, omitting the detachable burner assembly which is normally positioned in front of the combustion air-inlet opening of the unit, as shown in Figure 2;

Figure 8 is a view in side elevation of the heat transfer unit of Figure 7 showing the arrangement of its exhaust gas (upper) duct and its combustion air (lower) inlet duct;

Figure 9 is a view in rear elevation of the heat transfer unit of Figure 7, the view showing further details of the form and arrangement of its lower, or air-inlet, duct and of its upper, or exhaust-gas, duct;

Figure 10 is a view in elevation of the dorsal side of the front half-section of the heat transfer unit of Figure 7;

Figure 11 is a view in elevation of the dorsal side of the back half-section of the heat transfer unit of Figure 7;

Figure 12 is a fragmentary view in elevation with parts in section of a detail of the pilot light and igniter apparatus of the burner assembly shown in Figure 3;

Figure 13 is a view in section taken along the lines 13–13 of Figure 12;

Figure 14 is a view in top plan of the removable burner assembly shown in installed position in Figure 1 and in Figure 2, the view omitting the thermo-control means and igniter means for clarity;

Figure 15 is a view in front elevation of the burner shown in Figure 14, the burner holder being shown in part in dotted outline; and,

Figure 16 is a view in section with parts broken away taken along the line 16–16 of Figure 14.

In general, and in accordance with this invention, there is provided a space heating device comprising in combination hollow heat transfer means providing a burner-fitted combustion chamber which is hermetically sealed with respect to the space to be heated; a combustion air inlet into said combustion chamber adjacent one end thereof and an exhaust gas outlet from said heat transfer means adjacent the other end thereof; a vane-fitted baffle structure having an inlet opening associated with said combustion air inlet and an outlet opening associated with said exhaust gas outlet, the vanes of said baffle structure maintaining a uni-directional flow of combustion air and combustion products from said air inlet through said heat transfer means to said exhaust gas outlet; and spaced conduits for connecting said baffle structure to said heat transfer means at said inlet and said outlet, said conduits being adjustable so that said baffle structure and said heat transfer means may be moved relatively toward and away from each other.

Preferably the baffle structure is adapted for installation at the atmospheric side of an outside room wall, and the heat transfer means is disposed at the room side of the wall structure, the connecting conduits being adjustable as to length for adjustably connecting said baffle structure to said heat transfer means at said inlet and said outlet, whereby said heat transfer means and said baffle structure may be moved toward and away from each other to compensate for variations in thickness of different walls.

The baffle structure may comprise a hood-like member for disposal at the atmospheric side of a wall structure, said hood-like mem-

ber having a Venturi outlet opening adjacent said exhaust gas outlet and an air inlet opening with funnel means thereat and adjacent said air inlet to said combustion chamber, said conduits connecting said hood-like member through the wall structure to said heat transfer means at said inlet and said outlet.

The baffle member may comprise an elongated hollow member for disposition at the atmospheric side of a wall structure with its long axis vertical for effecting said unidirectional flow of combustion air and combustion products through said heat transfer means from said air inlet to said exhaust gas outlet.

The heating device may have a horizontally disposed air deflecting vane extending through said air inlet opening into the interior of said heat transfer means and dividing said air inlet opening into unequal areas, a vertically disposed deflecting vane bisecting said inlet, a pair of vertically disposed deflecting vanes at opposite sides of said inlet and at an angle to said vertical vane, and deflecting vanes interiorly at its top forming a Venturi passageway at its said exhaust outlet.

Means are also provided for mounting the heating device in a wall structure for use as a wall-inserted circulating space heater. For small units of, for example, 20,000 B.T.U. per hour capacity, the heat transfer means is preferably of dimensions that will permit its installation with necessary accessories between adjacent units of the usual 2 x 4 wall studding which ordinarily is spaced from 13 to 16 inches on centres. For larger units of, for example, 40,000 B.T.U. capacity, a spacing of 26 to 32 inches between alternate studs is generally required.

It will be understood that the following detailed description is exemplary and explanatory of the invention but not restrictive thereof.

Referring now more particularly to the accompanying drawings, there is depicted one form of space heating apparatus in accordance with this invention. The device in Figures 1 and 2 in particular is shown installed in an outside wall structure of conventional construction comprising, for example, an inner lath and plaster layer 1 at the room side, vertical studs 2 on the usual centres, and an outer sheathing and siding layer 3 at the atmosphere side. The heating device is adapted to be installed in such a wall structure partly within and partly without the space to be heated and in its general organization comprises a mounting case or box-shaped member 4 dimensioned for installation between a pair of the adjacent wall studs 2 and having provision for attaching it to the outer sheathing layer 3; a convector case 5 adapted to be nested in and carried by the box-shaped member 4; an internally fired finned heat transfer unit 6 adapted to be contained in and carried by the convector case, having a combustion air inlet 7 and an exhaust gas outlet 8; a hood-like vane-fitted baffle structure 9 adapted to be fixedly supported against the outer sheathing layer 3 so as to form a combustion air flow and exhaust gas directing chamber at the atmospheric side of the space to be heated, the chamber communicating through the sheathing layer with the inlet 7 and outlet 8 by adjustable conduit members 10 and 11, respectively; and a louvred panel-forming member 13 adapted to be carried by the convector case as a closure in position over the wall opening and to form a finishing cover for the device at the room side.

The heat transfer unit 6 as embodied is preferably of sectional construction facilitating fabrication, the unit sections preferably being castings of aluminium alloy offering both light weight and low cost and providing more uniform heat in operation. As here preferably embodied, front and rear sections 14 and 15, respectively, are suitably fashioned to provide therebetween in assembled relationship a combustion chamber 16 extending generally from bottom to top of the unit.

The combustion chamber 16 is preferably of greater length than width and in such case a ratio of length to width in the order of two and a half to one, has been found to be advantageous. The lower end of the combustion chamber forms a burner compartment 17 having provision therein for burning a combustible fuel air mixture and adapted to be supplied with external air for combustion through the air inlet port 7. Except for the air inlet port 7 and the exhaust gas port 8, the combustion chamber 16 is hermetically sealed so that under operating conditions no communication is provided between the combustion chamber and the space to be heated. A substantially uniform taper is preferably imparted to the combustion chamber from a locus substantially at the top of the burner compartment 17 to the top of the chamber in order to maintain a more uniform velocity of combustion products through the chamber as they cool. To this end, the front and rear walls of the unit 6 are disposed in slightly converging relationship from the burner compartment to the top of the unit.

The exhaust gas outlet 8 is located at some distance below the top of the combustion chamber and, in order to prevent the products of combustion from flowing directly out of the exhaust gas outlet before they have traversed the entire heat-transfer surface of the chamber, baffles are provided within the chamber 16 substantially at the exhaust outlet, such baffles serving to deflect the rising stream of combustion products on

either side of the outlet and to the top of the combustion before they are permitted to escape. As here preferably embodied, a substantially U-shaped member 18 integral with the front section 14 of the unit 6, traverses the combustion chamber substantially from front to rear so as to provide an open-topped enclosure extending around the outlet 8 from its bottom to above its top. A substantially complementary U-shaped member 19 extends into the combustion chamber for a short distance from the rear section 15 of the unit 6 with which it is integral and substantially snugly telescopically engages the outer surface of the member 18 at its free end (see Figures 2 and 6).

A system of heat absorbing fins 20 in the combustion chamber 16 provides an extended surface area therewithin for securing a high heat recovery from the hot gaseous products of combustion moving toward the exhaust outlet. As here preferably embodied, each of the sections 14 and 15 of the heat transfer unit is provided with a set of the fins 20 integral therewith which project from the one section in substantial parallelism (see Figures 10 and 11), but in staggered relation to the fins of the other section, for a short distance into the combustion chamber 16. This staggered relationship of the fins of the opposing sets is best seen in Figure 6 and has the advantage of effecting a high degree of heat recovery from the combustion products. Each of the fins 20 extends preferably uninterruptedly from the burner compartment 17 through the balance of the length of the combustion chamber 16 except in the vicinity of the deflecting baffle members 18 and 19. In these locations, those fins which would otherwise intersect these members are interrupted at a short distance from either side of the flange (see Figures 10 and 11) so as to avoid blocking of the flow of combustion products by the creation of pockets at the junction of the fins and deflecting baffle members. Moreover, the fins 20 are preferably omitted entirely within the confines of the baffle member 19 of the rear section 15 thereby to facilitate the free outward flow in this location of the combustion products through the exhaust outlet 8. The fins 20 are preferably of equal and uniform height throughout their length except over that portion thereof situated above the baffle members 18 and 19, where a pattern of low and high fins is provided selected to effect a maximum of heat recovery from the hot combustion products in this area under the conditions of fluid flow there existing. To this end, and as is best seen in Figure 6, the arrangement is such that for the respective section 14 and 15, the fin pattern of each section is symmetrical with respect to its vertical median plane S–S in Figure 6. The fins of the section 15 to the right of this plane, as viewed in Figure 6, are arranged in the order of one short, one long, two short and one long, reading inwardly from the terminal fin, while the fins of the section 14 are arranged in the order of two short, one long and two short, reading similarly. By this arrangement, each long fin of one section lies between two short ones of the other section, and the separate streams of hot gases rising on each side of the baffle members 18 and 19 and flowing into the portion of the combustion chamber thereabove are caused to pursue a more or less undulating path in turbulent flow toward each other from the opposite sides of the unit, to the common exhaust gas outlet 8. A high degree of heat recovery in the last stages of the combustion chamber is thereby achieved.

A system of heat-radiating fins 21 is provided on the outer surface of the heat transfer unit 6 operating to provide an extended surface area for effecting a high rate of heat transfer to circulating room air flowing upwardly around the unit. As here preferably embodied, the external fins 21 are vertically disposed in separate sets of parallel or substantially parallel units on and integral with the front and rear sections 14 and 15 respectively (see Figures 7, 8 and 9). The fins 21 on the front section 14 extend to the top of the unit 6 from a locus substantially coincident with the top of the burner compartment 17 whereas the fins on the rear section 15 extend substantially the full length of the unit except at the air inlet and exhaust gas openings 7 and 8, respectively, as is best seen in Fig. 9. By thus diminishing the total radiating surface at the front of the burner compartment 17, a more advantageous pre-heating of the combustion air may be realized.

The front section 14 of the heat transfer unit 6 is cut away along a line extending from side to side of the unit adjacent the top of the burner compartment 17, so as to accommodate a lower cover element 23, constituting a detachable wall portion of the burner compartment and serving as a readily removable closure or cover member therefor supporting a burner 24 removably in position therewithin. Means are provided for releasably but separately securing the front section 14 and the lower cover element 23 to the rear section 15 in hermetically sealed relationship to the latter and to each other along their meeting edges. To these ends, the rear section 15 is provided with a continuous marginal groove 25 in which a suitable sealing gasket 26 is adapted to be lodged and compressed throughout the length of the groove by a marginal sealing tongue 27 provided on the front section 14 and by a

marginal sealing tongue 28 provided on the lower cover element 23. The front section 14 is also provided with a bottom marginal groove 29 (Figure 10) in which a suitable sealing gasket 30 (Figure 2) is adapted to be lodged and compressed therein by a portion of the tongue 28 formed on the lower cover member 23. Bolting lugs 31 formed on and integral with the rear section 15 and with the separate element 23 and front section 14 at suitably spaced intervals function in conjunction with suitable bolting means such as the nut-bolt sets 32, to draw the front and rear sections and cover element together into firm sealing engagement with each other at their marginal meeting faces.

The burner means 24 as embodied is detachably carried by the lower cover member 23 so as to be removable as a unit therewith and is constructed and arranged so as to permit of the burning of a combustible fuel-air mixture within and substantially over the width of the combustion chamber at a level which is preferably slightly above the top of the air-inlet port 7. The embodied burner means is of a construction moreover permitting manual adjustment at will of the fuel-air ratio within the burner mixing chamber, from a position outside the heat transfer unit. As here preferably embodied, the burner 24 is provided with a relatively long and narrow flat combustion surface portion 35 having the relatively closely spaced, parallel flame slots 36 which are preferably precisely formed to provide in operation a substantially continuous wall of flame from end to end of the combustion surface portion. The flame slots 36 lead into a header chamber 37 within the interior of a header portion 38 of the burner. In order to maintain a substantially uniform distribution of a combustible fuel-air mixture to the flame slots 36 over the entire length of the combustion surface 35, the header portion 38, and hence the header chamber 37, is provided with a substantially uniform taper from its inlet end (the right hand end as viewed in Figure 15) to its opposite end and from bottom to top, as is best seen in Figures 14 and 16. A hollow Venturi choke portion 39 having communication with the inlet end of the header chamber 37 is disposed directly below the header portion 38 and extends parallel thereto throughout the major portion of its length. The choke portion 39 is integral with the header portion 38 and terminates at its free end in a mixing chamber 40 having a fuel supply port 41 and an air supply port 42. An air valve member 43 is pivotally mounted over the air supply port 42 by means of a screw stud 44 which passes through the valve member 43 into threaded seated engagement with the choke portion 39. The stud 44 when seated should not offer any substantial or material resistance to pivotal movement of the valve member 43 into and out of position over the air inlet port 42.

Means are provided for detachably, securely supporting the burner 24 within and by the cover member 23 so that the cover-burner assembly may be readily and easily installed in and removed from the heat transfer unit 6, as a unit. The supporting means as here preferably embodied comprises a positioning boss 45 integral with the header portion 38, the boss having a conical recess 46 in its free end providing a seat for a complementary positioning boss 47 integral with the cover member 23. A second positioning boss 48 extends outwardly from the burner at the opposite end toward the cover member 23 which in turn is provided with a complementary boss 49 providing a seat for the boss 48. The bosses 48 and 49 are provided each at their meeting faces with oppositely inclined intersecting surfaces since such an arrangement of intersecting surfaces serves to position the burner more accurately with respect to the cover member, than would be the case where the inclined surfaces did not intersect but terminated for example in a plane surface.

A bolting and reinforcing web 50 connects and stiffens the header and choke portions 38 and 39, respectively of the burner and is apertured as at 51 for the passage of the shank of a securing bolt 52 whose head engages the outer face of the cover member 23. A nut 53 carried by the bolt 52 and bearing against the web 50 serves to draw the burner and burner cover firmly together into the selected position fixed by the locating bosses 45, 47, 48 and 49.

Means are provided also for adjusting the setting of the air valve shutter 43 from outside the heat transfer unit 6, for controlling the fuel-air ratio of the combustible mixture at the burner mixing chamber. As here preferably embodied, the shutter 43 is provided with an adjusting lever arm 55 which is integral with the main body portion of the shutter but disposed in overlying spaced relation to the shutter pivot stud 44. The arm 55 is apertured as at 56 to receive, in non-rotatable engagement therewith, the flat terminal portion of a screw 57 whose shank is coaxially aligned with the pivot stud 44 and passes through the cover member 23 in threaded engagement therewith. A lock nut 58 on the screw shank at the outside of the cover member permits of fixing the screw, and hence the shutter member 43, in a determined selected position to which the screw may be turned by means of a suitable tool (not shown) engageable with the screw head.

Means are provided within the combustion chamber 16 for minimizing localized heating of the heat transfer unit 6 in the wall areas

thereof closely adjacent to the flame created by the burner 24 when in operation. The embodied means functions to establish a generally annular insulating layer of relatively fast moving and cool air within the combustion chamber circumferentially of the combustion surface 35 of the burner between the intensely hot burner flame and the contiguous wall portions of the heat transfer unit 6. As here preferably embodied the front and rear sections 14 and 15 of the heat transfer unit are provided within the combustion chamber 16 each with a substantially horizontal surface portion 60 extending toward the other for a short distance so as to form an air-guiding baffle extending continuously circumferentially of the combustion surface 35 of the burner. Thus, air for combustion entering the burner compartment 17 through the air inlet 7 will flow upwardly around the burner and through the more or less annular restricted passage between it and the air-guiding baffle 60, thus causing the air to sweep inwardly toward and thence upwardly with the flame to shield the closely adjacent walls of the heat transfer unit from the intense direct radiation of the flame.

In accordance with this invention also, the heat transfer unit 6 is provided with suitable thermostatically controlled safety pilot means preferably removable as a unit with the burner-cover assembly. The burner cover 23 is provided in its bottom surface for this purpose with an aperture 61, (Figure 14) through which a safety-pilot unit 61a extends upwardly into the burner compartment in operative relationship to the burner 24 therewithin. Units of this nature are well-known in the gas heating industry and the details thereof are unimportant. In general, however, the unit comprises the pilot burner 62 disposed alongside a valved thermo-responsive main fuel supply header 63 having a conventional spud connection 64 with the fuel supply port of the burner 24, as indicated in Figures 3 and 12. Both the fuel supply header 63 and the pilot burner 62 are carried by a flanged header fitting 65 sealingly engaging the cover member 23 about the aperture 61 and having connection with a main fuel supply pipe 66, and with a by-pass pipe 67 for supplying fuel to the pilot burner. The main fuel supply pipe 66 is provided with a manually adjustable thermostatically controlled fuel supply valve 68 to which access may be had for setting through an aperture 69 in the room panel member 13.

Suitable igniter means are also provided enabling the pilot burner 62 to be ignited without opening the heat transfer unit. As here preferably embodied, an igniter plug 70 is screwed into the face of the burner cover 23 (see Figure 13) and is provided with an igniter wheel 71 journalled by means of a shaft 72 in the plug and adapted to frictionally engage a spring-pressed flint 73 for producing a stream of sparks directed against the pilot burner 62. The shaft 72 terminates in a manually engageable end portion and the plug is preferably sealed against leakage of combustion products around the shaft 72 by means of a sealing cap 73a which threadedly removably engages the plug and extends through an opening 74 in the room panel cover 13. It will be understood that the burner cover 23 may be provided additionally with a separate plugged lighter opening (not shown) preferably adjacent the pilot burner 62, through which the pilot burner may be lighted with a match, if safety requirements necessitate such a construction. An observation port 75 in the front section 14 of the heat transfer unit is suitably located with reference to the combustion surface 35 of the burner 24 as to permit viewing the flame through a companion observation port 76 in the room panel, as indicated by the dot dash sight lines in Figure 2. The port 75 may comprise a quartz window suitably detachably mounted in the section 14. The external fins 21 are preferably terminated slightly above the port 75 in the area immediately surrounding the port so as to minimize obstruction of the sight line.

The heat transfer unit 6 is supported from the convector case 5 by means of a set of rearwardly extending brackets 77, which as here preferably embodied are four in number and are cast integral with the rear section 15 of the unit. The brackets are releasably secured to the convector case each by a nut-bolt unit 103 or other suitable securing means.

Fixed conduits 78 and 79 cast integral with the rear section 15 of the heat transfer unit extend rearwardly therefrom in parallel relation to each other, from the air inlet and exhaust gas outlet 7 and 8, respectively. The free termini or ends of these conduits lie in substantially the same plane and they are preferably of rectangular contour with their long axes vertically disposed.

The adjustable conduits 10 and 11 previously mentioned are of complementary contour in cross-section to the fixed conduits 78 and 79, respectively, and are snugly but freely, slidably telescopically received within the conduits 78 and 79 respectively, and are of a length taken each with that of its companion fixed conduit, as to provide therewith a duct axially variable in length by an amount sufficient to permit the duct to extend or be extended through a suitable opening in walls of substantially different thicknesses, to the atmosphere side of the

space to be heated.

The adjustable conduits 10 and 11 terminate at their outer ends in the hollow interior of the hood-like baffle structure 9 which provides a system of air-directing and guiding vanes and surfaces for funnelling combustion air into the burner compartment 17 through the air inlet duct formed by the conduits 10 and 78, and for assisting, by Venturi action, in the withdrawal of products of combustion from the combustion chamber 16 through the exhaust gas duct formed by the conduits 11 and 79, thereby ensuring the maintenance of a unidirectional flow of air for combustion and of products of combustion, through the combustion chamber regardless of the direction or velocity of the wind at the atmosphere side of the hood-like baffle.

The baffle structure 9 is secured in position over the outer ends of the conduits 10 and 11 by suitable means such as the pair of stay bolts 82 releasably anchored at their inner ends each to a separate unit of a pair of anchor brackets 83 fixedly secured to the rough-in box 4, preferably in parallel relation to each other, across an elongated opening 84 in the rear wall of the box-shaped mounting member 4.

A stiff insulating panel 85 of suitable heat insulating and weather-resistant material is provided for disposition between the baffle 9 and the outer sheathing layer of the building structure. The panel member 85 is suitably apertured for the passage of the conduits 10 and 11 and of the baffle anchor bolts 82, but is otherwise preferably imperforate. It functions to seal the opening formed in the wall structure against the elements, to which end it may be caulked around its edges, and it also provides a closure for the opening 84 in the box-shaped member 4 and for the hood-like baffle 9.

The baffle structure 9 as here preferably embodied is a relatively elongated and more or less pan-shaped or hood-like member adapted to be installed in an upright position with its long axis substantially vertical and with its interior presented to the conduits 10 and 11. Thus disposed, the hood-like baffle 9 offers to the atmosphere a substantially flat-surfaced outer wall 86 substantially paralleling the sheathing layer 3 in closely spaced relation thereto, and top, bottom and side walls which fall substantially directly away from the wall 86 to the panel member 85 with which they make substantially sealing engagement, leaving a vertical air chamber 81 between said wall and panel.

An air-inlet opening 87 is provided in the wall 86 opposite the mouth of the conduit 10 and a system of air-directing and guiding surfaces and vanes is provided at the opening 87 for funnelling moving air therethrough into the conduit 10 regardless of the direction from which the moving air stream approaches the hood-like baffle in the immediate vicinity of the opening 87.

The vane system as here preferably embodied, comprises vertical and horizontal vanes 88 and 89, respectively, intersecting each other and extending from the wall 86 at right angles or substantially right angles thereto. The vertical vane 88 bisects the opening 87 into equal parts and preferably extends for a short distance above its top margin while terminating substantially at its bottom margin. The horizontal vane 89 also bisects the opening 87 but is preferably located nearer the bottom margin of the opening 87 than its top margin, and advantageously at about two-thirds of the distance down from the top margin. Moreover, the horizontal vane 89 is preferably of somewhat greater width than that of the opening 87 and extends a greater distance out from the wall 86 than does the vertical fin 88. A gradual reduction in width of the vane 89 to that of the opening is effected however at a short distance from the opening and the vane is preferably extended through the opening into the chamber 81 for a substantial distance thereacross, advantageously for two-thirds of the distance across the chamber toward the mouth of the conduit 10.

In addition to the vanes 88 and 89, side vanes 90 are provided one on each side of the opening. The vanes 90 extend from substantially the bottom margin to a level somewhat above the top margin of the opening and are disposed at angles to the wall portion 86 in outwardly diverging relation thereto, advantageously at an angle of about 45° to the wall 86 so as to form a funnel entrance to the opening.

It will be noted that from the arrangement and disposition of the vanes 88, 89 and 90 at the mouth of the air-inlet opening 87, air moving either across or at angles to the plane of the opening will be intercepted and directed, that is, funnelled into the opening 87 into the conduit. Moreover, strong down drafts or up drafts are intercepted by the correspondingly large area horizontal vane 89 and diverted into the opening 87 with equal facility. Strong upward movement of air in the chamber 81, which would tend to blanket the exhaust gas discharge conduit 11 at the top of the chamber, is substantially eliminated by the extension of the horizontal vane 89 into the chamber 81. Thus, the major portion of an air stream moving rapidly upward against the horizontal vane 89 would be deflected into the air-inlet opening 87 and conduit 10, but would be prevented from coursing upwardly in the chamber 81 by the portion of the vane 89 in the chamber. The low position of the inner extension of the

vane 89 is of particular importance where the upwardly moving air stream is at a small angle of approach to the plane of the opening 87. However, there is under this condition, as well as when air is blowing toward the hood 9 from other directions, a minor shunt flow of air upwardly in the chamber 81 from the air-inlet opening 87 toward the hood outlet.

Exhaust gas outlet openings 91 are provided in the upper portion of the hood-baffle in the respective side walls at diametrically opposite sides of the exhaust gas discharge conduit 11. The wall portion 86 of the hood-baffle is preferably imperforate except for the air-inlet opening 87 above noted and accordingly serves to shield the mouth of the exhaust gas conduit 11, and hence the exhaust gas outlet 8, against air blowing directly toward that outlet, that is, axially of the conduits 11 and 79. The openings 91, however, permit the escape of the exhaust gas or products of combustion laterally from the hood-baffle behind the plane of the wall portion 86 in a region remote from the air inlet opening 87 so that their natural tendency to rise tends to carry them away from the air inlet opening and thus minimize any possibility of recirculation and outages of the burner flame from such cause.

Venturi means are provided also at the discharge end of the hood-baffle for utilizing the kinetic energy of air blowing at the baffle openings 91 in the maintaining of a unidirectional flow of air and combustion products through the combustion chamber. As here preferably embodied, a pair of upright vanes 92 each preferably at least co-extensive in length with the respective baffle openings 91 are disposed within the chamber 81 adjacent the openings 91 and in converging relation to each other inwardly from the respective side walls of the hood-baffle. The vanes 92 are preferably integral with the side walls and at their free ends are spaced apart a distance corresponding substantially to the width of the conduit 11 to provide an opening into what corresponds generally and in effect to the throat of a Venturi passage connecting the baffle openings 91 and formed by the vanes 92 and the wall portion 86 of the hood baffle. By reason of this arrangement of surfaces, air blowing at the baffle openings 91 from either side direction will be guided through the hood-baffle past the mouth of the conduit 11 and out of the opposite opening 91. In its passage, however, it will produce in a greater or less degree a pressure drop at the throat of the Venturi passage which will be communicated to the combustion chamber 16 and serve to increase the natural draft through the combustion chamber. It will be apparent that the combination of increased pressure at the air inlet 7 of the combustion chamber due to the funnelling action of the vane system at the air-inlet baffle opening 87 and the reduced pressure at the exhaust gas outlet 8 due to the Venturi action between the baffle outlet ports 91, will result in the maintenance of a pressure drop through the combustion chamber under conditions of both moderate and high wind velocity, which will be effective in both magnitude and direction to maintain the necessary unidirectional flow through the combustion chamber under all practical conditions of operation.

In order to protect the flame of the pilot burner 62 against being accidentally extinguished by sudden gusts entering through the air inlet 7, a shield member 94 is fastened to the front face of the burner mixing chamber as by means of a screw 95 and provides a barrier across the burner compartment from the bottom to closely adjacent the burner top so that the pilot burner will be protected against the direct impact of air gusts sweeping under the burner upwardly around the mixing chamber end.

The box-shaped member 4 is adapted to be secured to the sheathing 3 of the building structure as by means of screws 96, with its opening 84 aligned with a corresponding opening in the sheathing layer. A rearwardly extending flange 97 extends circumferentially of the opening 84 and in the installed position of the box-shaped member is substantially snugly and telescopically received within the opening formed in the sheathing layer.

A bat 98 of rock wool or other suitable heat-insulating material fills the opening 84 between the outer insulating panel 85 and a corresponding inner insulating panel 99. Both the panels 85 and 99 and the bat 98 are suitably apertured for the passage of the conduits 10 and 11 and the securing bolts 82. The inner panel 99 is disposed against the rear wall of the member 4 in the space between that member and the convector case 5 and serves as a spacing member therebetween as well as co-acting with the outer panel 85 to hold the insulating bat 98 in a more or less compressed state in the opening 84 of the member 4. If desired, the insulating bat 98 may be secured directly to the marginal flange 97 of the box-shaped member and may terminate between the conduits 10 and 11 since insulation of the air-inlet conduit 10 is not a prime necessity.

The convector case 5 is carried by the member 4 in nested spaced relation thereto upon suitable brackets 100 to which the convector case is detachably secured as by means of bolts 101 passing through the oppositely extending side flanges. Apertures 102 are provided in the back wall of

the convector case for the passage of the air inlet and exhaust gas conduits 78 and 79, respectively of the heat transfer unit 6 which latter is carried in the convector case on the brackets 77 which are bolted at their free ends to the back wall of the convector case, as by means of the bolts 103. The spacing of the convector case from the member 4 is designed to permit of the free circulation of air between the two, thus minimizing heating of the member 4 *per se* and ensuring maintenance of safe temperatures on the surrounding wall structure.

The open front of the convector case 5 terminates adjacent its top portion in a discharge duct portion 104 extending forwardly outwardly from the body of the case beyond the face of the heat transfer unit 6 where it is adapted to discharge heated air into the space to be heated through a series of louvred openings 105 formed in the room panel or cover 13.

The openings 105 are sufficient in number and area to permit of the discharge of heated air therethrough in the quantities issuing from the convector case discharge duct 104 and to permit heated air which rises upwardly between the convector case and the box-shaped member into the space above the air discharge duct 104, to escape into the space to be heated through the openings 105.

Louvred openings 107 for the entry of the air to be heated are provided in the bottom portion of the panel cover 13 opposite the lower end of the convector case 5. Thus, cool air flows through these openings both into the interior of the convector case at the bottom and into the space around the convector case between the latter and the box-shaped member. In flowing upwardly over the heat transfer unit 6 the air is heated rapidly in a short distance as a result of the high heat generating and heat radiating capacity of the heat transfer unit, and is discharged through the duct portion 104 via the openings 105 back into the room. At no time, however, will there be any commingling of the room air with the products of combustion formed in the hermetically sealed combustion chamber 16 of the heat transfer unit 6.

Mounting of the room panel 13 in position over the opening formed in the wall structure to accommodate the elements of the heating apparatus as a whole, is effected by means of a series of brackets 108 carried by the convector case 5 and extending forwardly therefrom in opposition to the panel cover 13 to a locus where they are engaged by screws 109 passing through the panel cover into threaded engagement with the free ends of the brackets 108. The panel cover is of a configuration serving to enclose completely the opening in the wall structure and by reason of the compactness of the unit as a whole enabling its installation between adjacent wall studs, the panel cover extends but a short distance into the space to be heated.

It will be apparent that access to the heat transfer unit 6 may be readily effected by removal of the panel cover 13. Likewise, access to the burner for any purpose is readily effected by simply removing the burner cover 23 and the burner with it in a single operation.

The invention in its broader aspects is not limited to the specific mechanisms shown and described but departures may be made therefrom without departing from the principles of the invention and without sacrificing its chief advantages.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is :—

1. A space heating device comprising in combination hollow heat transfer means providing a burner-fitted combustion chamber which is hermetically sealed with respect to the space to be heated; a combustion air inlet into said combustion chamber adjacent one end thereof and an exhaust gas outlet from said heat transfer means adjacent the other end thereof; a vane-fitted baffle structure having an inlet opening associated with said combustion air inlet and an outlet opening associated with said exhaust gas outlet, the vanes of said baffle structure maintaining a uni-directional flow of combustion air and combustion products from said air inlet through said heat transfer means to said exhaust gas outlet; and spaced conduits for connecting said baffle structure to said heat transfer means at said inlet and said outlet, said conduits being adjustable so that said baffle structure and said heat transfer means may be moved relatively toward and away from each other.

2. A space heating device according to claim 1 in which said baffle structure is adapted for installation at the atmospheric side of an outside room wall.

3. A space heating device according to claim 2 in which said conduits are adjustable as to length for adjustably connecting said baffle structure to said heat transfer means at said inlet and said outlet whereby said heat transfer means and said baffle structure may be moved toward and away from each other to compensate for variations in thickness of different walls.

4. A space heating device according to any of claims 1 to 3 in which said heat transfer means is disposed at the room side of a wall structure.

5. A space heating device according to any of the preceding claims in which said baffle structure comprises a hood-like member for disposal at the atmospheric side of a wall structure, said hood-like member having a Venturi outlet opening adjacent said exhaust gas outlet and an air inlet opening with funnel means thereat and adjacent said air inlet to said combustion chamber; said conduits connecting said hood-like member through the wall structure to said heat transfer means at said inlet and said outlet.

6. A space heating device according to any of the preceding claims in which said baffle structure comprises an elongated hollow member for disposition at the atmospheric side of a wall structure with its long axis vertical for effecting said unidirectional flow of combustion air and combustion products through said heat transfer means from said air inlet to said exhaust gas outlet.

7. A space heating device according to any of the preceding claims having a horizontally disposed air deflecting vane extending through said air inlet opening into the interior of said heat transfer means and dividing said air inlet opening into unequal areas, a vertically disposed deflecting vane bisecting said inlet, a pair of vertically disposed deflecting vanes at opposite sides of said inlet and at an angle to said vertical vane, and deflecting vanes interiorly at its top forming a Venturi passageway at its said exhaust outlet.

8. A space heating device according to any of the preceding claims in which said hollow heat transfer means provides a combustion chamber having spaced front and rear walls, said combustion air inlet being in said rear wall adjacent one end of said heat transfer means, said exhaust gas outlet being in said rear wall between the other end of said heat transfer means and said air inlet, and stream-dividing baffle means extending between said walls at said exhaust gas outlet.

9. A space heating device according to claim 8 in which said heat transfer means has a removable wall portion in the front wall thereof opposite said air inlet, and means in said chamber carried by said wall portion for burning a combustible fuel-air mixture, and means operable from outside said chamber for adjusting the fuel-air ratio of said burning means.

10. A space heating device according to claim 9 having said hollow heat transfer means formed as a tapered hermetically sealed combustion chamber with a separate burner compartment having said combustion air inlet, and a restricted passageway connecting said chamber and said compartment, said means for burning fuel being disposed in said compartment substantially at the inlet of said passageway and forming an air stream dividing baffle thereat.

11. A space heating device according to any of claims 1 to 8 in which said hollow heat transfer means has a burner for fluid fuel in the interior thereof adjacent said combustion air inlet, air deflecting vanes in the interior of said heat transfer means at opposite sides of said burner, valve means on said burner for controlling the primary air intake thereof, means operable from outside said heat transfer means for adjusting said valve means, and means including a plurality of air directing vanes and surfaces for maintaining said unidirectional flow of combustion air and combustion products through said heat transfer means from said air inlet to said exhaust gas outlet.

12. A space heating device according to any of the preceding claims in which said heat transfer means has both internal and external fins providing an extended heat transfer area.

13. A space heating device according to any of the preceding claims having a box-shaped member adapted for installation between adjacent wall studs on the inside of a building structure, a convector case lodged in said box-shaped member, in spaced relation thereto, and a room panel cover for said convector case having an opening for admitting air to be heated to said convector case and a separate opening for the discharge of heated air therefrom, said hollow heat transfer means being enclosed in said convector case in spaced relation thereto.

14. A space heating device according to any of the preceding claims having a main burner in a burner compartment and a pilot burner at one end of the main burner, and means partitioning said burner compartment from side-to-side and from substantially top to bottom for shielding the flame of said pilot burner from gusts entering through said air inlet.

15. A space heating device having its parts arranged, adapted to operate and constructed substantially as hereinbefore described with reference to the accompanying drawings.

Dated this 25th day of June, 1948.
For the Applicant,
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Chartered Patent Agents,
2A, Charlwood Place, Westminster, S.W.1.

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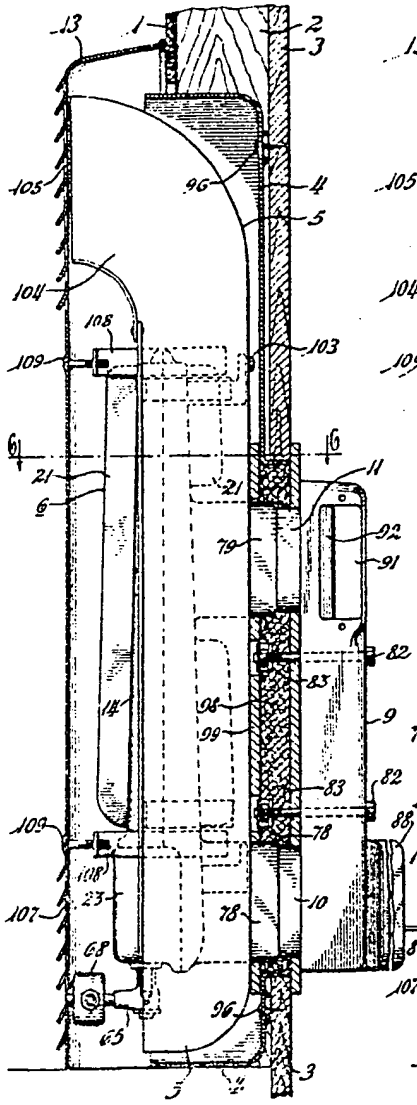


Fig. 1

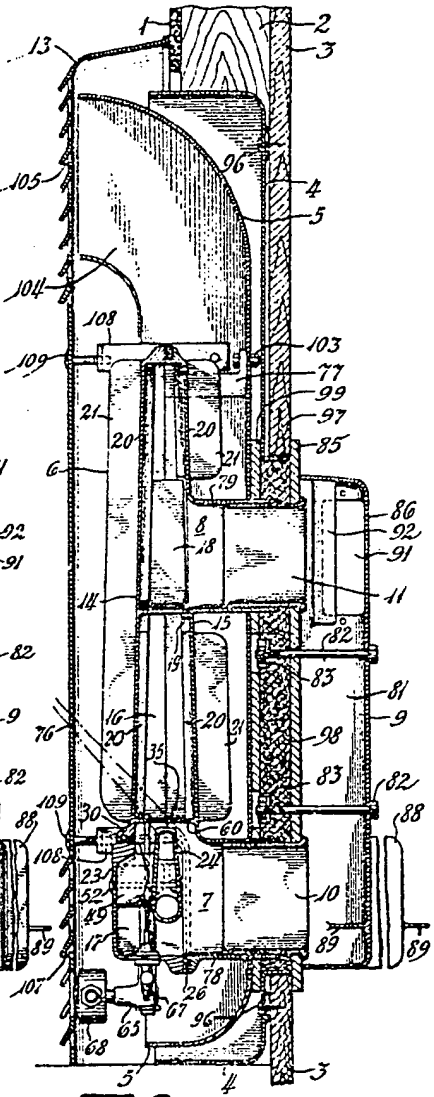
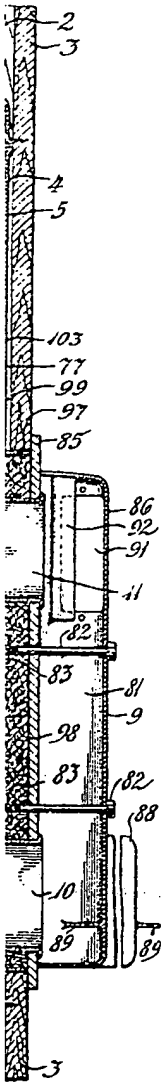


Fig. 2

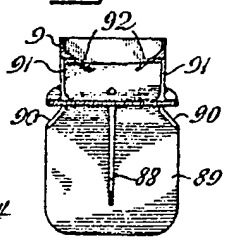
6 SHEETS

SHEET 1



SHEET 2

Fig. 4a



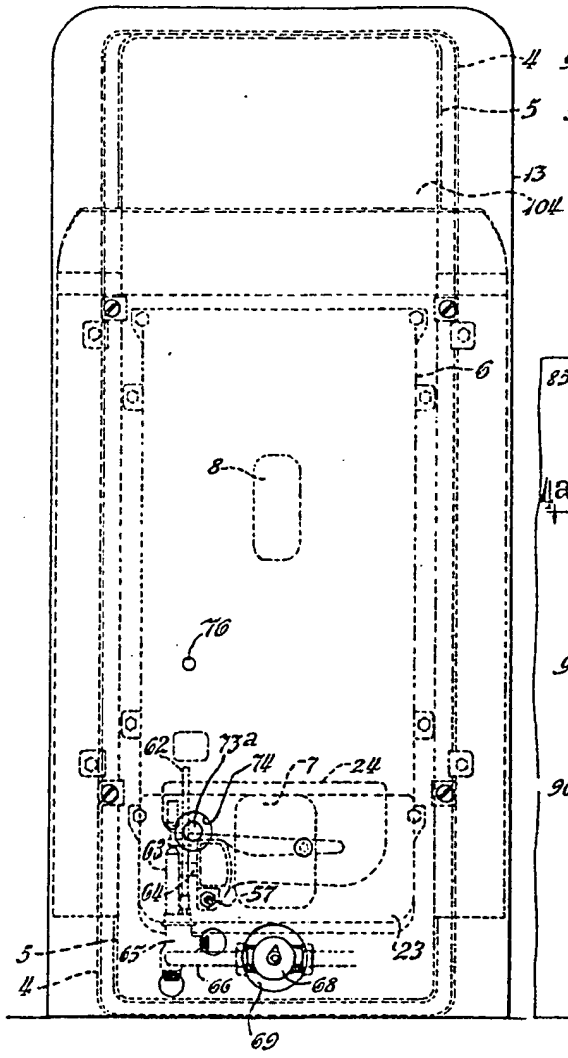
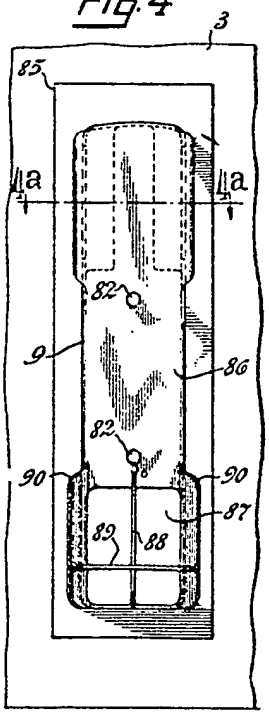


Fig. 3

Fig. 4



H.M.S.O. (M.F.P.)

669309 COMPLETE SPECIFICATION

6 SHEETS

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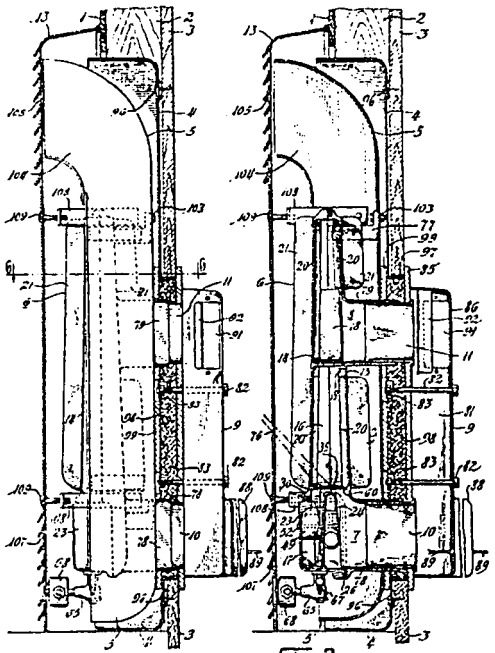


Fig. 1

Fig. 2

SHEET 2

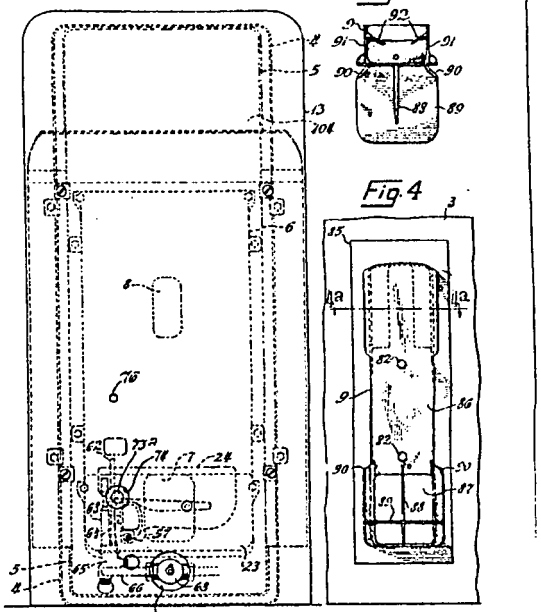


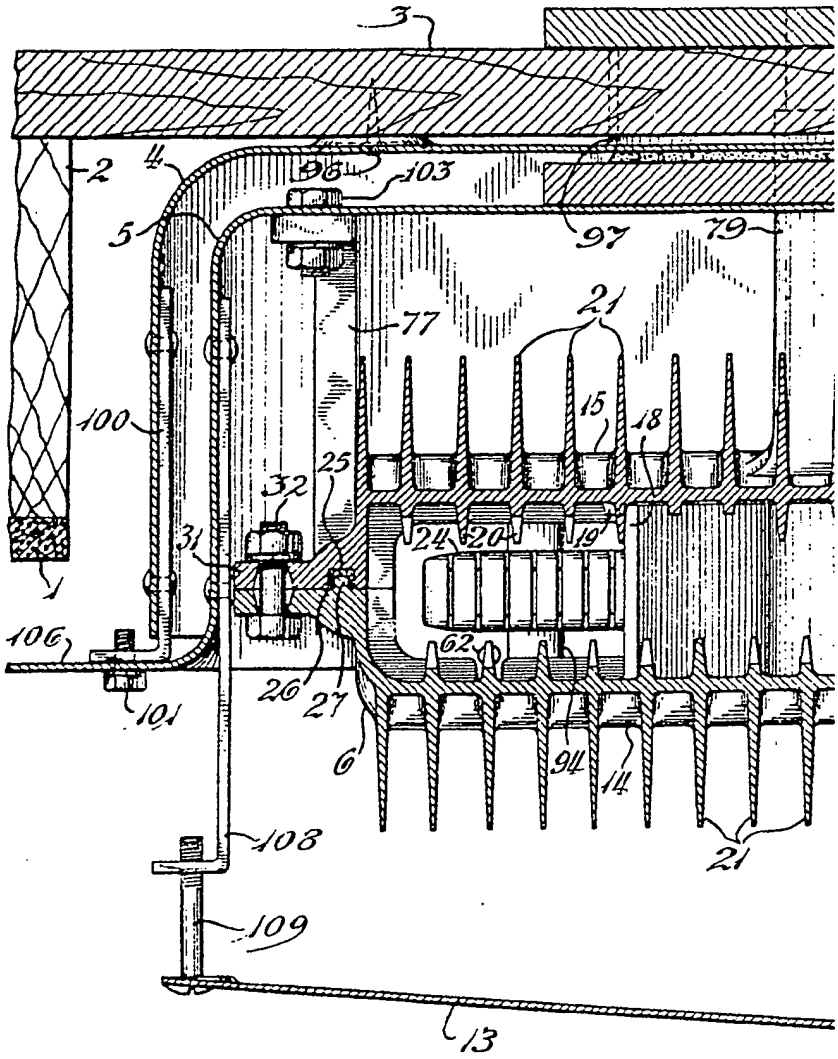
Fig. 3

Fig. 4a

Fig. 4

This Drawing is a reproduction of the Original on a reduced scale.

H.M.S.O.(M.F.P.)



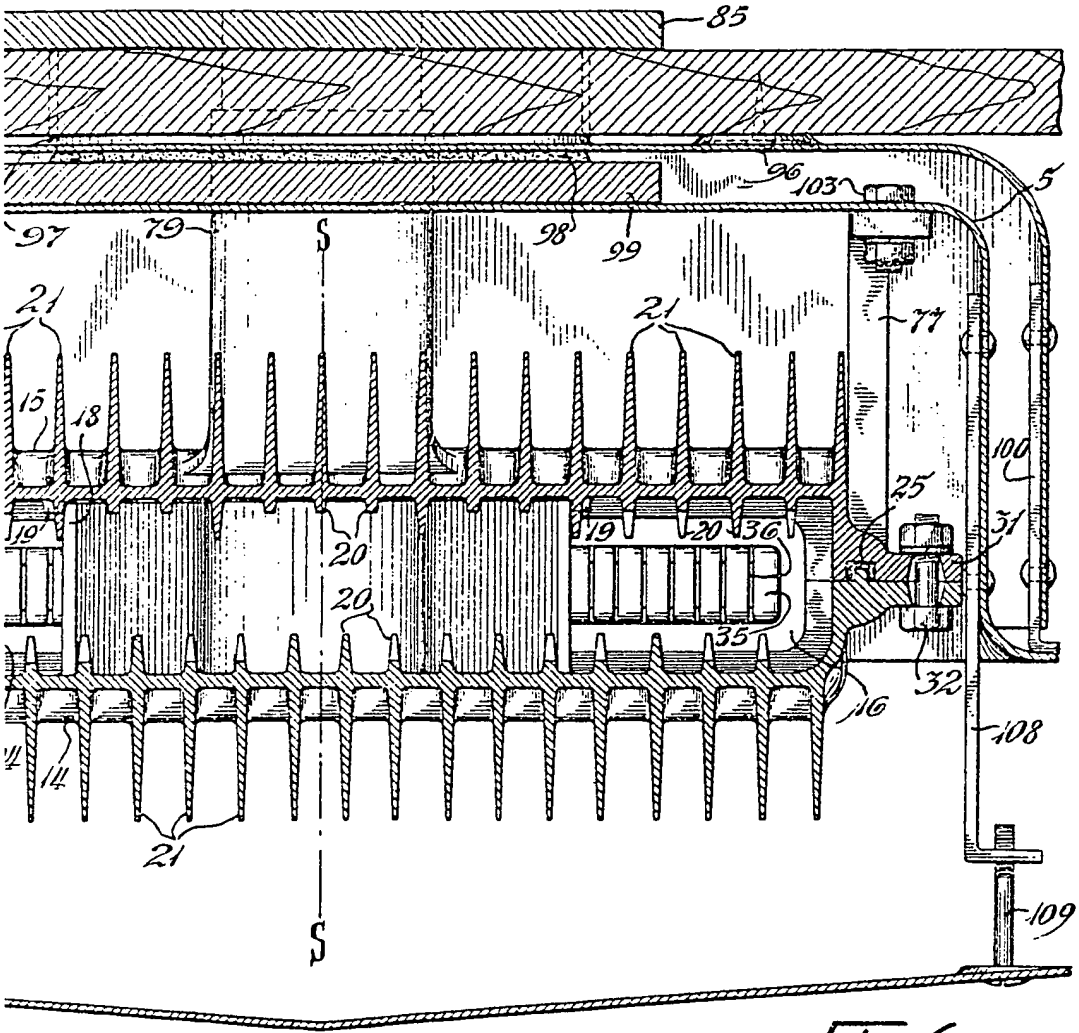


Fig. 6

669,309 COMPLETE SPECIFICATION

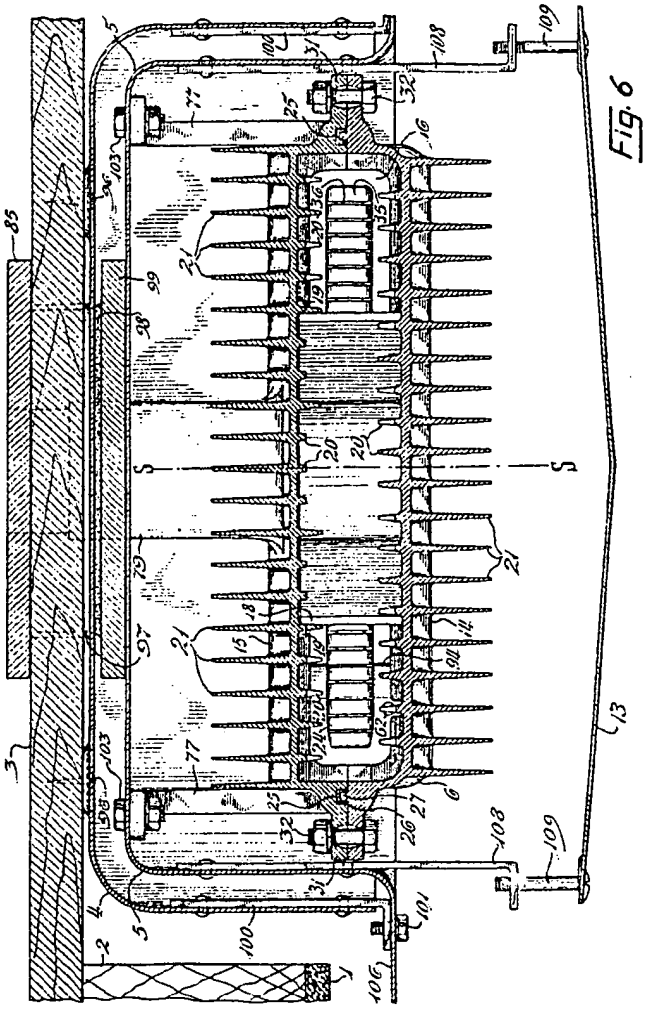


Fig. 6

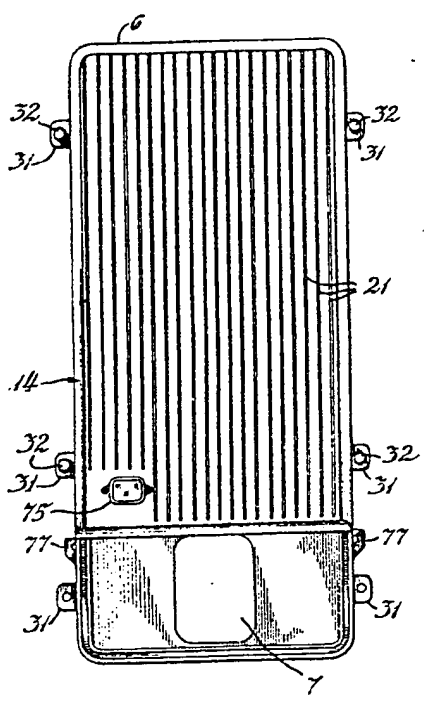


Fig. 7

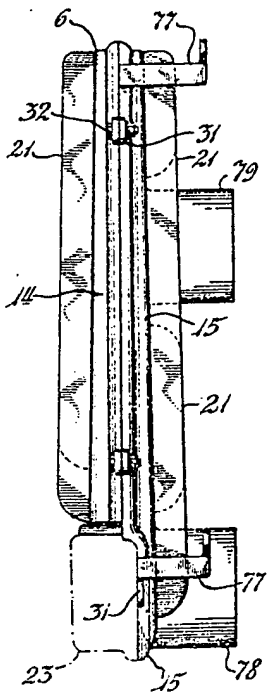


Fig. 8

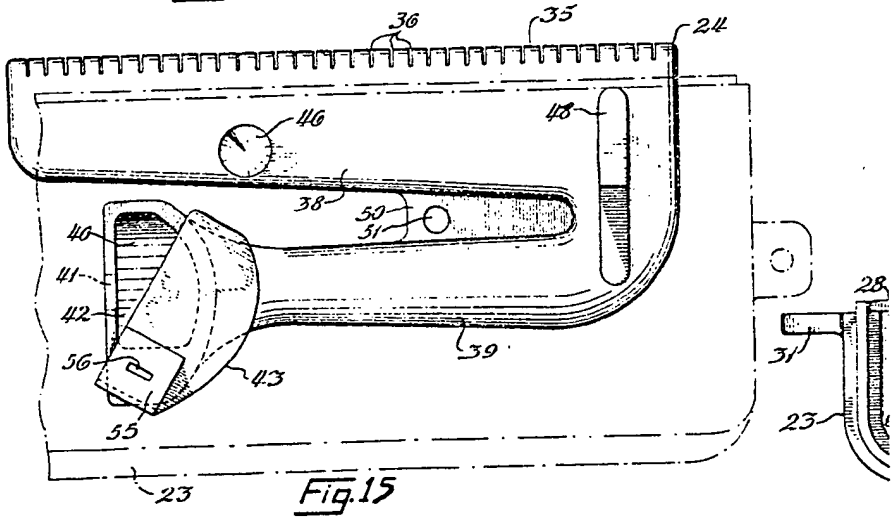
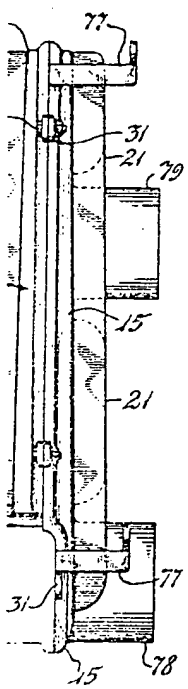


Fig. 15



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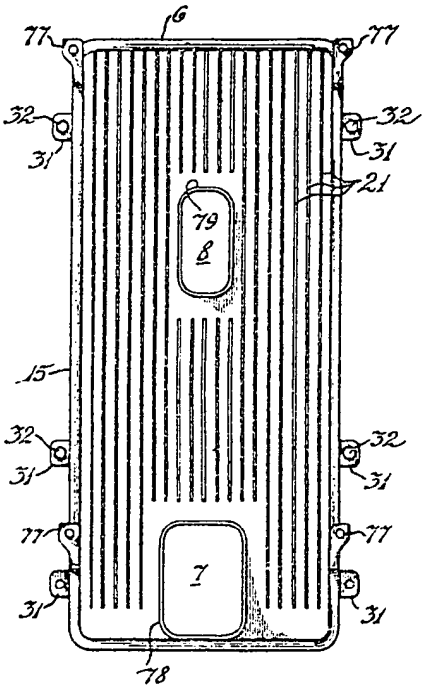
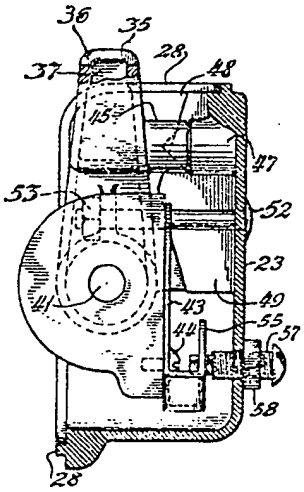


Fig. 9

Fig. 16



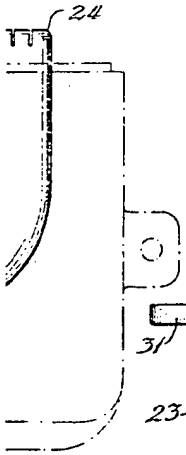
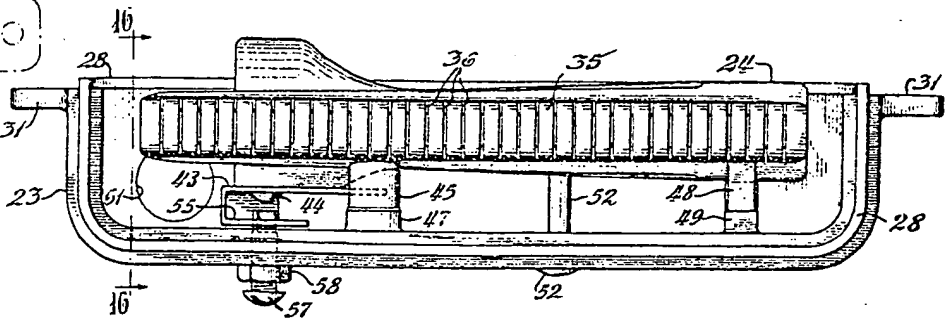


Fig. 14



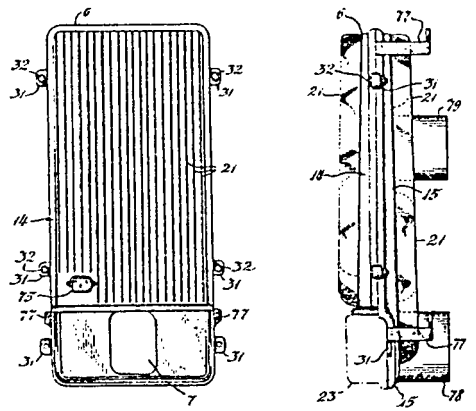
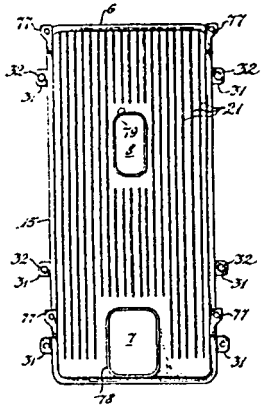


Fig. 7

Fig. 8



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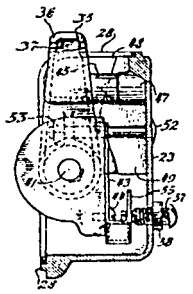
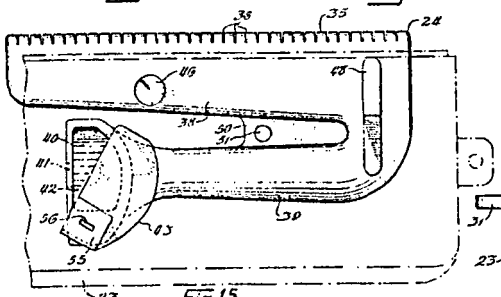


Fig. 16



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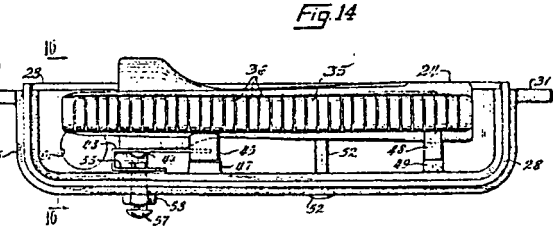
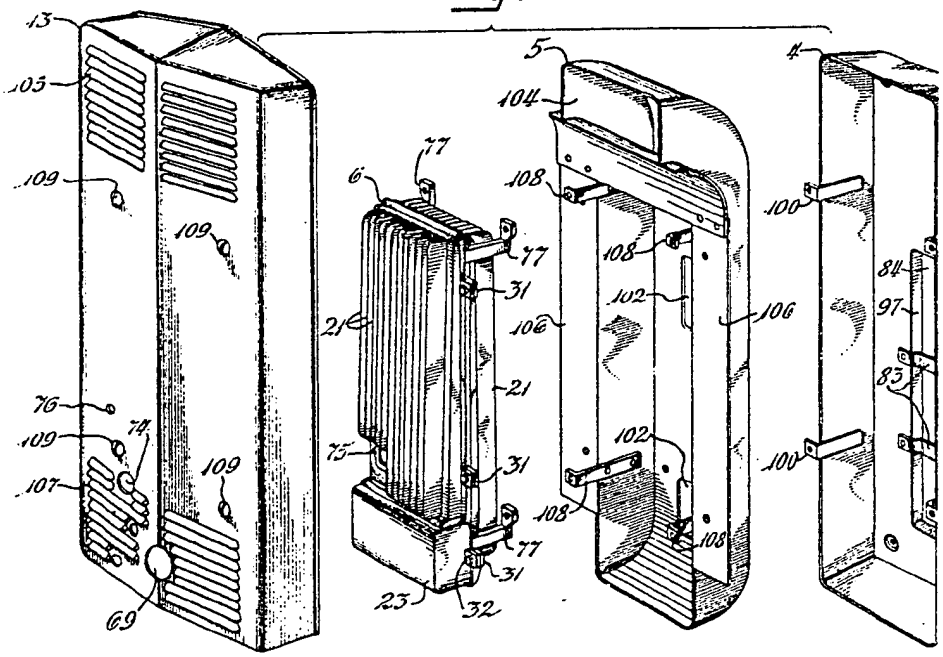


Fig. 14

Fig. 5



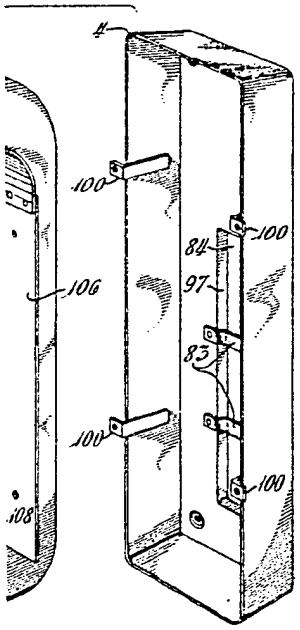


Fig.10

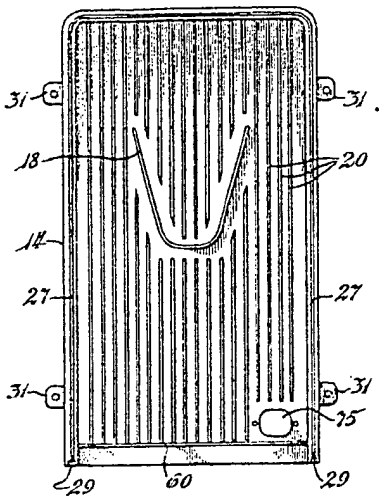
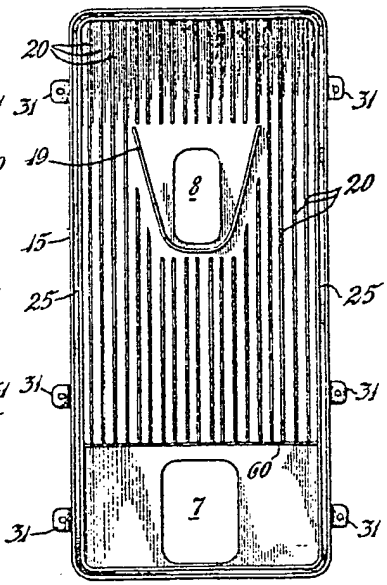


Fig.11



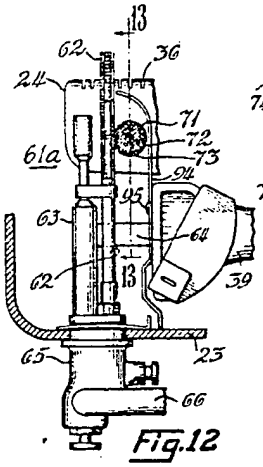


Fig.12

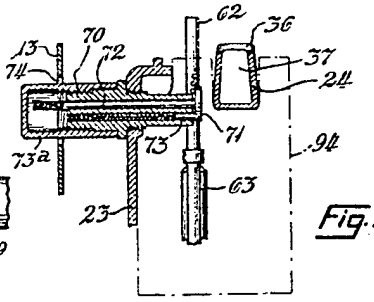


Fig.13

Fig. 5

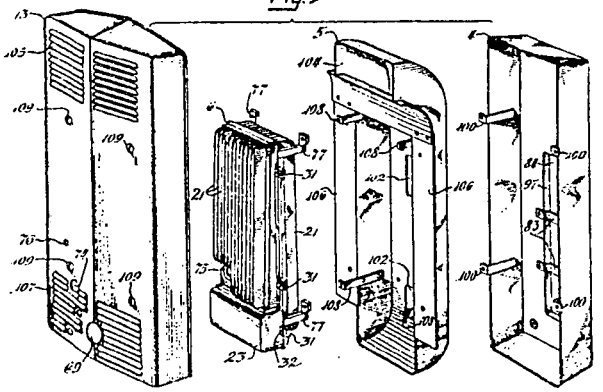
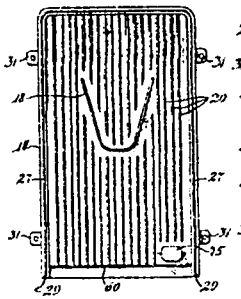


Fig. 10



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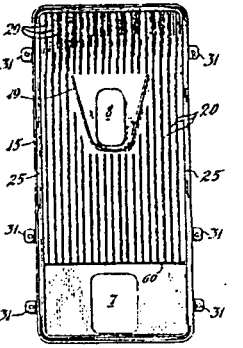

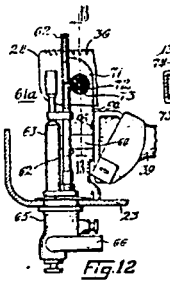

Fig. 12

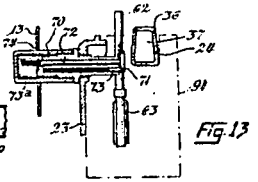

Fig. 13